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ABSTRACT

Presented is a survey study funded by the Educational Research Institute of British Columbia (ERIBC), Canada. The purpose of this study was to compare current practices used in the teaching of science to limited success students in British Columbia junior secondary schools and those practices advocated in the literature from other countries. A mail questionnaire was distributed to a selected sample of 336 junior science teachers in the province. Eighty-two percent of the sampled teachers (229) responded to the questionnaire. Teachers responded to questionnaire items on student grouping practices, class size, methods of current determination, approaches to learning, student evaluation, teacher background and teacher experience. The results of the responses were reported as frequency of responses and percentage response. Results provided a picture of current practices in British Columbia as perceived by the teachers sampled. Sixteen recommendations were also generated relating to science curriculum, teachers and school administration, teacher training and further research. (HM)

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ERIBC REPORTS

REPORT NO. 79:9

" A SUMMARY OF CURRENT PRACTICES IN B.C. JUNIOR SECONDARY SCIENCE WITH RESPECT TO LIMITED SUCCESS STUDENTS "

Peter S. Healy

SE 027 767

**Educational Research Institute
of
British Columbia**

REPORT NO.: 79:9

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The Limited Success Student in Science
A survey of current practices in teaching junior secondary science in British Columbia

A report to the Educational Research Institute
of British Columbia related to
Discretionary Grant No. 224

Submitted February 1, 1979

by Peter S. D. Healy
Science Department
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SUMMARY OF PROJECT

The purpose of this study was to:

1. Determine the status of current practices used in the teaching of science to limited success students in B.C. junior secondary schools

2. Compare the current practices in B.C. with those advocated in the literature from other countries

3. Produce a set of recommendations for the improvement of science education for limited success students

A mail questionnaire was developed based on the information gained in a literature review of the teaching of limited success students. The questionnaire was distributed to a selected sample of 336 junior science teachers in the Province of B.C. Eighty-two percent of the sampled teachers (299) responded to the questionnaire. Teachers responded to questionnaire items on: student grouping practices; class size; curricula; methods of content determination; approaches to learning; student evaluation; teacher background and teacher experience.

The results of the responses were reported as frequency of response and percentage response. Results provided a picture of current practices in B.C. as perceived by the teachers sampled. A comparison was made between the practices currently in use in B.C. (as teachers perceived them) and practices advocated in other countries (particularly Britain and the United States) as reported in the literature review.

Based upon the comparison between current practices in B.C. and those practices advocated in the literature, three major conclusions were arrived at:

1. A significantly large population of limited success students exists in B.C. junior secondary schools
2. A general awareness of the existence of a population of limited success students in B.C. is evident
3. Few special science programs have been developed for limited success students in B.C. Most junior secondary science teachers perceive the present recommended curriculum to be largely inappropriate for instructing limited success students.

In addition to the conclusions listed above a further sixteen recommendations were generated relating to the following: science curriculum; teachers and school administration; teacher training and further research.

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INTRODUCTION

The impetus for this study stems largely from the writer's experience as a junior secondary science teacher for a period of three years. During this three year period the writer instructed a number of "modified" science ten classes. The students in these classes were specially grouped for science due to their previous low achievement. These students had experienced "limited success" in science for various reasons and as a result showed both poor motivation and attitude. Standard teaching methods and curricula, used with some success with average and above average students, lacked effectiveness. Teaching style, curriculum, discipline, evaluation and homework required alteration to suit the abilities and nature of limited success science students. Much alteration originated by trial and error and from occasional assistance from more experienced teachers. At best, changes were based on intuition and the evaluation of these changes was highly subjective. Teacher training did not seem to adequately prepare for dealing with limited success students, special curricula seemed to be non-existent and related teaching methods were not evident.

The experience above prompted an examination of science education for limited success students. A literature review highlighted the paucity of research done in this area in British Columbia (B.C.). Only one formal study related to limited success science students at the junior secondary level had been carried out (Quelch 1975). The literature indicated that, in Britain and the United States, the size of the limited success student population was in excess of 20% of the total school population. It seemed reasonable to assume that a population of this size also existed in B.C.

Given the nature of limited success students, their probable numbers in the school population and the lack of research done in B.C., it seemed appropriate to investigate the current status of science education for these students. By obtaining an overall picture of science as taught to limited success students in B.C., needs were identified by comparing B.C. with other countries where research on limited success students had already occurred. Recommendations based on these needs were generated to provide a basis for further investigation of science for limited success students in the province.

To conduct a preliminary examination of science for limited success students in B.C. a mail questionnaire was developed and circulated to a sample of junior secondary science teachers. In chapter one the process of development, implementation and analysis of the questionnaire is presented. Chapter two outlines the results of the questionnaire response in tabular form. The conclusions and recommendations of the study are presented in chapter three.

CHAPTER 1

Development of the Descriptive Survey Instrument

Impetus and intents of survey

At the present time in B.C. there is one curriculum suggested for all junior secondary science students. This curriculum has been in use since 1968. Any modification of this curriculum and development of related teaching methods is carried out by individual schools or teachers with little discussion or communication. A search of the literature has revealed only one study in B.C. of junior secondary limited success science students (Queich 1975) as opposed to the large volume of literature from Britain and the United States. The probable size of the limited success student population in B.C. and the lack of local information and communication regarding these students and their science courses, has prompted the writer to become more familiar with this area of science education in B.C. schools.

As a first step in developing an understanding of science instruction for limited success students a descriptive survey has been conducted at the junior secondary level, grades eight, nine and ten.

The survey addressed itself to the following questions:

1. What is the size of the limited success student population at the junior secondary level in B.C.?
2. What educational practices (grouping, curriculum, approaches to learning, evaluation and reporting) are presently being used to teach science to limited success students?
3. What is the educational background and experience of teachers of limited success students?

Using the data obtained from the answers to the questions above it was possible to address the following broader issues:

1. How do established science teaching practices in B.C. compare with those developed outside B.C.? What implications, if any, do differences in practice have for limited success students, teachers, administrators and other institutions?
2. In what ways can science education be enhanced for limited success students?
3. What further research should be conducted?

Additional intents of the survey were: to provide a foundation for further communication with the teaching community; to expose the issues debated in the literature and provide additional information on relevant curricula and teaching methods from Britain, the United States and Australia.

Survey instrument design

In order to address the broad questions outlined in the introduction to this chapter, a teacher questionnaire was developed.

Source of questionnaire items

The review of the literature revealed a number of areas pertinent to the teaching of limited success students. These areas included: the characteristics of limited success students; appropriate teaching methods for limited success students and appropriate teacher attitudes, characteristics and training. The most prevalent statements and suggestions occurring within the identified areas were used to generate the questionnaire items. For example, the literature suggested a number of different ways in which a science course for limited success students could be developed. Teachers were asked to estimate the extent to which they based their science courses on the various methods of course development suggested in the literature. Other questionnaire items were produced by the writer to fill in additional information. For example, teachers were asked to provide information on the school size and timetable for science in their particular school.

Specific information covered by questionnaire items

The items of the questionnaire asked for specific information in the following areas:

1. Students
    - size of the limited success student population
    - distribution of limited success students by sex
    - achievement of limited success students
2. Teachers
    - undergraduate and graduate backgrounds
    - teacher training related to limited success students
    - total teaching experience
    - teaching experience with limited success students
    - present subject areas and grades taught
3. Science Programs
    - appropriateness and use of text(s) and laboratory manual(s)
    - course content determination
    - teaching methods
    - student evaluation
    - science program evaluation
4. Schools
    - grade level range
    - population of school
    - school timetable for science (full year/semester)
    - number of hours of science per week
    - science class size

Questionnaire format

Information was elicited from teachers through multiple choice questionnaire items. Whenever appropriate, space was provided to allow for teacher comment. The format of each item was chosen by considering the nature of the information required and by modelling questions on previously successful questionnaires (Hambleton 1970, B.C. Learning Assessment Junior Secondary Science Teacher Survey 1978, Nasr 1977).

The questionnaire was divided into three major sections:

1. The first section dealt with teacher background and school information
2. The second section was preceded by a statement indicating the double-branched nature of the questionnaire. One branch was answered by teachers who taught science to limited success students in homogeneously grouped classes. The parallel branch was responded to by teachers who taught science to these students in heterogeneously grouped classes
3. The third section was responded to by all teachers. This section dealt with the structure and content of teachers' junior science programs

Evaluation of questionnaire prior to distribution

Initial versions of the questionnaire were examined and revised through consultation with thesis committee members. Additional comments were elicited through administration of the questionnaire to seven junior secondary science teachers in Richmond School District. Three of these teachers taught science in homogeneously grouped classes while the remaining four teachers taught in heterogeneously grouped science classes. The seven teachers were asked to complete a pilot version of the questionnaire and comment on its content and format. Further consultation with thesis committee members and use of the information from the pilot resulted in the final version of the questionnaire (Appendix A). Due to the lack of major ambiguity evidenced in the first pilot a second pilot was deemed unnecessary.

Reliability

The questionnaire was designed to sample teachers' interpretation of the nature and structure of their science courses for limited success students. Teachers also reported on their educational background and teacher training. Most of the information requested was factual in origin. Kerlinger (1973), in his discussion on checking survey data, cites Parten (1950) whose work on surveys has shown that the reliability of "personal factual items"[1] is high. It was also assumed that the kind of information requested would not change radically over the 1978 portion of the school year. Given the nature of the data constancy and the previous findings on reliability of surveys the questionnaire was judged to have a sufficiently high level of reliability.

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[1] Fred N. Kerlinger, Foundations of Behavioral Research 2nd ed., (New York: Holt Rinehart and Winston, Inc. 1973), p. 417.

Sampling plan

The population sampled was defined to be those teachers teaching at least one of science eight, nine or ten in the public schools of B.C. Many junior science teachers teach more than one grade level of science, for example grade eight and ten. Ministry of Education statistics[1] report the total number of teachers instructing science eight, nine and ten. Hence a teacher might appear in the Ministry listing up to three times. Some form of sampling was required to chose teachers only once and to ensure an equal representation of teachers at each grade level. Permission was granted by the Ministry of Education to use the sampling frame recently employed by the Science Learning Assessment Survey. This sampling frame, developed by B.C. Research,[2] utilized the information teachers submitted to the Ministry of Education in September 1977. The sampling frame labelled each teacher as a grade eight, nine or ten teacher according to their teaching load. For example, a teacher teaching two grade eight science classes, one grade nine science class and four classes in other subject areas would have a twothirds probability of being chosen as a science eight teacher and a one-third probability of being chosen as a science nine teacher. When chosen, each teacher was assigned a grade level for science by probability and was removed from the population to prevent a second selection. The population size determined by the sampling frame yielded the following numbers:

---

[1] At the beginning of each school year all B.C. teachers are required to complete form "J" for the Ministry of Education. This form requires teachers to list the training and teaching experience they have had in addition to the subjects and teaching load they presently carry.

[2] B.C. Research, 3650 Wesbrook Mall, Vancouver, Canada V6S 2L2.

Science 8 : N = 439
Science 9 : N = 425
Science 10 : N = 444
Total N = 1308

Using this total it was possible to calculate the sample size (n) by applying Cochran's (1963) formula[1] and given the following information:

level of confidence	= 95% ($z = 2.00$)
maximum allowable error	= 5% ($e = 0.05$)
maximum variance	= 50% ($p = 0.5$)

$$n = \frac{Nz^2 pq}{Ne^2 + z^2 pq} \qquad \text{where } q = 1 - p$$

substituting for N, z, p and q

$$n = 306 \text{ or } 23.4\% \text{ of the population.}$$

---

[1] William G. Cochran, Sampling Techniques, 2nd ed., (New York: John Wiley and Sons Inc. 1963), p.75.

Thirteen percent of B.C. school districts did not wish to participate in the survey. To ensure an adequate sample size in advance of contacting all school districts it was decided to add a minimum of 10% more teachers to the sample. B.C. Research suggested a sample size of 25% or 33% for the random systematic sampling method used (Appendix B). A 33% sample was chosen to allow for non-participating school districts and to provide a greater base for generalizability of results. The sampling procedure used a randomly chosen starting point and then selected every third teacher at each grade level. The number of teachers sampled at each grade level was:

Science 8 : n = 146
Science 9 : n = 142
Science 10 : n = 148
Total n = 436

A final sample size of 366 (28%) was utilized after the teachers from the non-participating school districts were deleted. The final distribution of teachers was:

Science 8 : n = 125
Science 9 : n = 122
Science 10 : n = 119
Total n = 366

Procedures

Superintendents of all B.C. school districts were contacted by mail prior to the distribution of questionnaires. Once authorization was obtained from the Superintendents to conduct the survey in their district, Principals of the teachers involved were notified of the intent of the study and asked to cooperate. Shortly after the letters to the Principals were mailed the questionnaire was distributed to the science teachers.

Sampled teachers received a covering letter, a questionnaire and a pre-stamped, self-addressed return envelope. All questionnaires were coded with a three digit number in order to implement follow-up procedures. These follow-up procedures were initiated approximately ten days after the initial questionnaire mailing.

Analysis

Upon receipt of the completed questionnaires, the responses were coded and punched on computer cards. The U.B.C. Multivariate Contingency Tabulations computer program (MVTAB) was used to calculate both frequency of response and percentage response to items of the questionnaire. Most analysis required only univariate considerations. However, certain comparisons between response items were required, such as between provisions for limited success students and non-limited success students in homogeneously grouped classes. To make comparisons such as this the bivariate option of the MVTAB program was used.

The results of this analysis are discussed in the following chapter.

CHAPTER 2

RESULTS

Introduction

In this chapter the results of the questionnaire, as reported by the sample of B.C. junior secondary science teachers, are presented. Tables of related results are grouped together under the following headings:

- Questionnaire response (page 16)
- Demographic data (page 17)
- Teaching experience (page 19)
- Schools (page 21)
- Extent and composition of the limited success student population in B.C. (page 22)
- Teaching methods presently in use for limited success students in B.C. (page 27)
- Teacher attitudes and training (page 53)

Tables of results are not necessarily listed in the order that the corresponding items of the questionnaire occur. To aid cross-reference with the corresponding questionnaire item the number of the item appears in parenthesis preceeding the table title. Each table reports both the frequency and percent response to the questionnaire item.

A number of questionnaire items were multiple response items (e.g. item one and thirteen). Teachers had the option to check more than one alternative within such an item. The analysis of these items required each alternative to be considered as a separate item. Therefore the percent response reported in a related table does not necessarily total 100. The tables reporting multiple response item results have an asterisk (*) following the table number.

Questionnaire response

A total of 336 questionnaires were mailed on May 15, 1978 to the sample teachers. The school districts participating (87% of B.C. school districts) represented a wide range of rural/urban and socioeconomic areas in the Province. Approximately 220 questionnaires were returned by May 26, 1978 at which point 145 follow-up letters and questionnaires were mailed. By June 30, 1978 310 (85%) questionnaires had been returned. A total of 299 (82%) of the returned questionnaires were suitable for analysis purposes.[1]

Approximately an equal number of grade eight (n=98 or 33%), grade nine (n=94 or 31%) and grade ten (n=107 or 36%) teachers completed the questionnaire.

Of the 299 teachers responding to the questionnaire twenty-two said that both homogeneous and heterogeneous science teaching occurred in their school. These teachers replied to both branches of the questionnaire.

---

[1] Eleven sample teachers did not teach science at the junior secondary level or were not at the school indicated by the sampling.

Demographic Data

Education background of questionnaire respondents

Tables 1.1 and 1.2 outline the undergraduate and graduate background of the respondents.

(1a) TABLE 1.1 *

UNDERGRADUATE MAJOR(S) OR CONCENTRATION(S)

Subject Area	Frequency of Response	Percentage of Response (%)
Biology	152	51
Chemistry	117	39
Physics	64	21
Earth Science	26	9
Space Science	7	2
Other	104	35

Of the 104 teachers reporting other undergraduate majors(s) or concentrations, twenty-nine (10%) had other areas of science listed, forty-six (15%) listed a non-science and science background (e.g. English and biology) and twenty-eight (9%) reported a non-science background (e.g. math, physical education, history).

(1b) TABLE 1.2 *

HIGHER DEGREES

Degree Obtained	Frequency of Response	Percentage of Response (%)
No higher degree	239	80
M.Sc.	21	7
M.A.	10	3
M.Ed.	21	7
Ph.D. (or equivalent)	5	2
Other	7	2

Of the seven teachers reporting other higher degrees one reported an M.Sc. in education, another an M.B.A. and one M.A.Sc. Four respondents did not indicate the nature of their higher degree.

Teaching experience

The total teaching experience of the respondents and their experience teaching science to limited success students in homogeneous groups can be determined by examination of tables 2.1, 2.2 and 2.3.

(3) TABLE 2.1

OVERALL TEACHING EXPERIENCE

Years of Experience	Frequency of Response	Percentage of Response (%) (n=299)
First	21	7
Second or third	48	16
Fourth to ninth	117	39
Tenth or over	112	38
No response	1	<1
Totals	299	100

(4a) TABLE 2.2

PREVIOUS EXPERIENCE TEACHING LIMITED SUCCESS STUDENTS SCIENCE IN A HOMOGENEOUS CLASS GROUP AT THE JUNIOR SECONDARY LEVEL

Previous Experience	Frequency of Response	Percentage of Response (%) (n=299)
Yes	169	57
No	129	43
No Response	1	<1
Totals	299	100

(4b) TABLE 2.3

YEAR OF TEACHING CAREER THAT RESPONDENTS FIRST TAUGHT SCIENCE TO LIMITED SUCCESS STUDENTS IN A HOMOGENEOUS CLASS GROUP

Year of Teaching Career	Frequency of Response	Percentage of Response (%) (n=299)
First	64	21
Second	23	8
Third	27	9
Fourth	10	3
Fifth or above	45	15
No response	1	<1
Totals	169	57

Table 2.1 shows that 77% of all respondents reported four years or more teaching experience. Only 23% reported three years or less teaching experience. Fifty-seven percent of respondents indicated that they did have previous experience teaching limited success students science in a homogeneous class group. Of the teachers who did report this previous experience 51% said they first taught these classes in their first or second year of teaching. Since more than half of the respondents (51%) reported their first experience with homogeneously grouped limited success science students in their first or second year it seems

evident that often previous teaching experience has not been considered before assignment to these classes.

Schools

Table 3.1 indicates the types of school (in terms of grades taught) in which the respondents reported teaching. For comparison purposes table 3.1 also gives figures as reported by Information Services of the B.C. Ministry of Education.

(6a) TABLE 3.1

GRADES TAUGHT IN SCHOOLS

Grades Taught	Number and Percentage of Schools	
	Reported by the Ministry of Education[1]	Reported by Respondents[2]
8 - 10	112 (34)	123 (41)
8 - 12	96 (29)	106 (36)
10 - 12	27 (8)	20 (7)
9 - 12	7 (2)	9 (3)
8 - 9	11 (3)	6 (2)
K - 12	10 (3)	4 (1)
Other	68 (21)	27 (9)
No Response	-	4 (1)
Totals	331 (100)	299 (100)

[1] Numbers in parentheses refer to percentage of total schools in the categories listed.

[2] Numbers in parentheses refer to percentage of response.

Table 3.1 shows more responses than schools that actually exist in the grade eight to ten category, the ten to twelve category and the nine to twelve category. Because some schools had more than one science teacher responding to the questionnaire the numer of responses is in some instances greater than the number of schools. It can be seen that the types of schools, as reported by respondents, closely reflects the actual distribution as reported by the Ministry of Education.

Extent and composition of the limited success student population in B.C.

Population size

An estimation of the size of the limited success student population was provided by teachers in both homogeneous and heterogeneous teaching situations. Teachers of heterogeneously grouped science classes estimated percentages directly (table 4.2). Information from teachers of homogeneously grouped limited success science students included the total number of classes taught at each grade level which, when divided into the total number of limited success science classes taught, yielded a total percentage of teaching load (table 4.1). The estimates of teachers from both homogeneous and heterogeneous teaching situations were merged to provide an overall estimate for the Province (table 4.3). Since some respondents teach more than one grade level of homogeneously grouped limited success students and others teach both heterogeneously and homogeneously grouped classes, the effective total response in table 4.3 was 338.

(8)-(9) TABLE 4.1

PROPORTION OF LIMITED SUCCESS STUDENTS IN B.C. JUNIOR HIGH SCHOOLS AS REPORTED BY TEACHERS OF HOMOGENEOUSLY GROUPED SCIENCE CLASSES

Percentage of Teaching Load	Frequency of Response				Percentage of Response (%) (n = 146)
	Grade 8	Grade 9	Grade 10	Total	
Up to 20%	1	4	4	9	6
Up to 33%	13	12	8	33	23
Up to 50%	11	7	23	41	28
Over 50%	13	18	18	49	33
No Response	0	6	8	14	10
Sub-totals	38	47	61	146	100
Sub-percentages	26	32	42	100	

(17) TABLE 4.2

PROPORTION OF LIMITED SUCCESS STUDENTS IN B.C. JUNIOR HIGH SCHOOLS AS REPORTED BY TEACHERS OF HETEROGENEOUSLY GROUPED SCIENCE CLASSES

Percentage of Students	Frequency of Response	Percentage of Response (%) (n = 192)
Up to 10%	78	41
Up to 20%	75	39
Up to 33%	25	13
Up to 50%	8	4
Over 50%	4	2
No Response	2	1
Totals	192	100

TABLE 4.3

PROPORTION OF LIMITED SUCCESS STUDENTS IN JUNIOR HIGH SCHOOLS AS REPORTED BY ALL QUESTIONNAIRE RESPONDENTS

Percent of Overall Student Population	Frequency of Response	Percentage of Response (%) (n = 338)
Up to 10%	78	23
Up to 20%	84	25
Up to 33%	58	17
Up to 50%	49	14
Over 50%	53	16
No Response	16	5
Totals	338	100

Table 4.1 shows an increase in reported ability grouping from grade eight to grade ten. Teachers of heterogeneously grouped science classes (table 4.2) seem to identify a smaller population of limited success students than do teachers of homogeneously grouped classes (table 4.1). Forty-seven percent of all respondents report a limited success student population of 20% or higher.

The figures listed in tables 4.1 to 4.3 indicate that a limited success student population of significant size exists in B.C. junior secondary schools.

Composition of limited success student population

Table 5.1 shows the distribution of limited success students by sex as reported by teachers of grouped science classes. This table also shows an overall distribution of limited success students by sex obtained by combining the figures for teachers of homogeneous and heterogeneous classes. Numbers in parentheses refer to percentage response, these are preceeded by figures of frequency of response.

(11,18) TABLE 5.1

RELATIVE PROPORTION OF LIMITED SUCCESS STUDENTS BY SEX

Proportion	Frequency and Percentage Response[1]		
	Homogeneously Grouped Classes (n=127)	Heterogeneously Grouped Classes (n=192)	Homogeneously and Heterogeneously Grouped Classes (n=321)
All boys	1 (<1)	1 (<1)	2 (1)
Well over half boys	28 (22)	53 (28)	81 (25)
About half boys and half girls	77 (61)	124 (65)	201 (63)
Well over half girls	5 (4)	9 (5)	14 (4)
All girls	1 (<1)	1 (<1)	2 (1)
No response	15 (12)	4 (2)	19 (7)

Twenty-eight percent of teachers of heterogeneous classes said that the composition of these classes ranged from well over half to all boys. Twenty-three percent of teachers of homogeneous classes reported similar class composition. Twenty-five percent of all respondents reported that well over half of their limited success students were boys while only 4% reported well over half girls. Evidently more boys experience limited success in science than girls.

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[1] Unless otherwise indicated items nine to twenty-one were analyzed on the basis of 321 respondents. Since twenty-two respondents replied to both homogeneous and heterogeneous grouping questionnaire branches the number of effective responses increased from 299 to 321. The teachers answering both of these branches reported doing so because both forms of grouping were practiced in the classes they taught.

Teaching methods presently in use for limited success science students

Grouping practices

This section outlines the responses of teachers to a number of questions regarding homogeneous and heterogeneous grouping practices. Tables 6.1 and 6.3 show the extent to which various grouping practices are utilized by respondents. Table 6.2 reports on the extent to which limited success students are promoted to a higher achievement level within a homogeneous grouping system. Table 6.4 indicates the differences in class size existing between homogeneously and heterogeneously grouped classes. Further comparisons between time tables and number of hours of science for limited success students in heterogeneous and homogeneous classes are reported in tables 6.5 and 6.6 respectively.

TABLE 6.1

TYPES OF GROUPING REPORTED

Type of Grouping	Frequency of Response	Percentage of Response (%) (n=299)
Homogeneous	105	35
Heterogeneous	170	57
Homogeneous and Heterogeneous	22	7
No data	2	1
Totals	299	100

Teachers' comments indicated that both homogeneous and heterogeneous grouping does occur within a single school. Comments showed that often grade eight and nine science were heterogeneously grouped while grade ten science was homogeneously grouped.

Teacher reports indicate that ability grouping is being practiced in 42% of all respondents' schools.

B

(12) TABLE 6.2

UPWARD MOBILITY OF LIMITED SUCCESS STUDENTS IN HOMOGENEOUSLY GROUPED CLASSES

Proportion of Upward Moving Students	Frequency of Response	Percentage of Response (%) (n=321)
All	4	1
Much more than half	15	5
About half	7	2
Well under half	31	10
None	57	19
No response	15	4
Totals	129	40

Table 6.2 shows that the majority of limited success students do not progress to higher achievement levels within a homogeneously grouped system. It seems that many limited success students tend to remain limited success students within a homogeneous grouping system. This finding may also be true for limited success students in heterogeneously grouped classes, however this was not examined in this study.

(19) TABLE 6.3

GROUPING WITHIN HETEROGENEOUS SCIENCE CLASSES

Occurrence of Grouping	Frequency of Response	Percentage of Response (%) (n=321)
Grouping does occur	14	4
Grouping does not occur	121	38
Grouping occurs sometimes	55	17
No response	4	1
Totals	194	60

Thirty-six percent of the respondents from heterogeneous teaching situations, group at least sometimes in these classes. The types of grouping used (as indicated by teacher comments) are varied, including: the pairing of a limited success student with a brighter student; an individualized learning program and the provision of core materials for all students with more challenging extensions for brighter students. Other teacher comments show the following further accommodations teachers make for limited success students:

- a more lenient marking scheme
- a reduced expectation for these students
- a grouping based on reading ability and previous math achievement
- a grouping based on friendship
- a grouping for special projects

Some teachers said that grouping was a very difficult and time consuming. A number of teachers said that the available laboratories and materials were inappropriate. A few said that identification of limited success students was a difficult task since they were not informed in advance who these students were.

(10a, 15a, 16) TABLE 6.4

AVERAGE CLASS SIZE

Class Size	Frequency and Percentage Response		
	Homogeneously Grouped Limited Success Students (n=321)	Homogeneously Grouped Non-Limited Success Students (n=321)	Heterogeneously Grouped Classes (n=321)
Less than 16	29 (9)	4 (1)	8 (2)
16 - 20	37 (11)	3 (1)	13 (4)
21 - 25	36 (11)	41 (13)	54 (17)
26 - 30	12 (4)	62 (19)	101 (31)
Over 30	2 (1)	3 (1)	13 (4)
No response	13 (4)	16 (5)	5 (2)
Totals	129 (40)	129 (40)	194 (60)

Table 6.4 indicates that 80% of homogeneously grouped science classes have twenty-five or fewer students in them. Table 6.4 also shows larger classes for non-limited success students in homogeneously grouped classes. Ninety percent of the teachers of homogeneously grouped non-limited success students state that the size of these classes is in excess of twenty-one students. A majority of teachers (59%) in heterogeneous grouping situations reported science class sizes in excess of twenty-six students. Since a class size not exceeding twenty-five students is advocated in the literature (Oxenhorn 1972, Collette 1973, Younie 1974) it appears as if many science classes of heterogeneously grouped students and homogeneously grouped non-limited success students exceed this recommended class size.

(10b, 15b, 20a) TABLE 6.5

TIME TABLES

Type of Timetable	Frequency and Percentage Response		
	Homogeneously Grouped Science Classes		Heterogeneously Grouped Science Classes (n=321)
	Limited Success Students (n=321)	Non-Limited Success Students (n=321)	
Regular or fullyear	65 (20)	59 (18)	90 (28)
Semestered	30 (9)	34 (11)	65 (20)
Quartered	13 (4)	14 (4)	18 (5)
Other	8 (2)	8 (2)	12 (4)
No Response	13 (4)	14 (4)	9 (3)
Totals	129 (40)	129 (40)	194 (60)

A bivariate comparison between the responses related to limited success students and non-limited success students indicated few time table differences (4%). Teachers of heterogeneously grouped science classes report a slightly higher proportion of semester system time tables than do teachers of homogeneous science classes.

(10c, 15c, 20b) TABLE 6.6

NUMBER OF HOURS OF SCIENCE PER WEEK

Hours of Science Per Week	Frequency and Percentage Response		
	Homogeneously Grouped Science Classes		Heterogeneously Grouped Science Classes (n=321)
	Limited Success Students (n=321)	Non-Limited Success Students (n=321)	
0 - 1 hour	0 (0)	0 (0)	1 (<1)
1 - 2 hours	3 (1)	1 (<1)	0 (0)
2 - 3 hours	25 (8)	22 (7)	31 (10)
3 - 4 hours	50 (16)	47 (15)	71 (22)
4 - 5 hours	24 (7)	27 (8)	56 (17)
5 - 6 hours	13 (4)	15 (5)	22 (7)
Over 6 hours	2 (1)	2 (<1)	7 (2)
No Response	12 (4)	15 (5)	6 (2)
Totals	129 (40)	129 (40)	194 (60)

A bivariate comparison between the responses related to limited success students and non-limited success students indicated few differences (4%) in the number of hours of science taught per week. Few major differences seem to exist between heterogeneous and homogeneous grouping in the number of hours of science provided per week. Dilution of science by reducing the number of hours per week does not appear to be a widespread practice in the instruction of limited success students.

Curriculum, teaching techniques and teaching technology

Curriculum

(25a) TABLE 7.1

NUMBER OF TEACHERS OFFERING SPECIAL PROGRAMS FOR THEIR LIMITED SUCCESS STUDENTS

Programs	Frequency of Response	Percentage of Response (%)
Special program offered	74	25
No special program	206	69
No response	19	6
Totals	299	100

(25a) TABLE 7.2

SPECIAL SCIENCE PROGRAMS AND ABILITY GROUPING

Type of Grouping	Frequency and Percentage Response		
	Special Program Offered (n=299)		
	Yes	No	No Response
Homogeneous	43 (14)	50 (17)	12 (4)
Heterogeneous	23 (8)	143 (48)	4 (1)
Homogeneous and heterogeneous	8 (3)	12 (4)	2 (1)

Teacher reports show that almost 70% of respondents do not provide a special science course for their limited success students (table 7.1). Of the teachers that do provide a special science program for these students 58% are teachers of homogeneously grouped science classes while 31% teach in heterogeneously grouped science classes. Evidently even if ability grouping is practiced many teachers do not differentiate the science program for their limited success students.

(7) TABLE 7.3 *

SUBJECT AREAS TAUGHT IN GRADE 8, 9 AND 10 SCIENCE

Subject	Frequency and Percentage Response		
	Grade 8	Grade 9	Grade 10
Physics	149 (50)	159 (53)	138 (46)
Chemistry	163 (55)	161 (54)	147 (49)
Biology	152 (51)	150 (50)	146 (49)
Earth Science	125 (42)	22 (7)	83 (28)
Space Science	7 (2)	75 (25)	9 (3)
Integrated Science	4 (1)	1 (<1)	5 (2)
Interdisciplinary Science	7 (2)	8 (3)	15 (5)

(22a) TABLE 7.4 *

TEXT(S) AND LABORATORY MANUALS USED IN THE INSTRUCTION OF LIMITED SUCCESS STUDENTS

Text or Laboratory Manual	Frequency of Response	Percentage of Response (%)
Introducing Science Concepts in the Laboratory	152	51
Developing Science Concepts in the Laboratory	146	49
Extending Science Concepts in the Laboratory	133	45
Pathways in Science (Oxenhorn)	31	10
Invitations to Investigate Science (Wong)	14	5
Other	100	33
A combination of the above	46	15
A modification of the above	47	16

One-third (33%) of the teachers responding to this survey reported the use of other texts, laboratory manuals and sources than those listed in item twenty-two. A further 15% of respondents reported modifications of existing curricula. Over thirty-seven different texts, laboratory manuals and sources were listed by teachers commenting on this item. Among the more prevalent of these alternate curricula are:

- teacher prepared worksheets, notes and laboratories
- Concepts and Challenges in Science (Winkler et al.)
- Modern General Science Series
- Intermediate Science Curriculum Study
- Mixtures in Chemistry
- locally developed units
- Cambridge Work-A-Texts
- Science in Action Series
- Spaceship Earth Series
- Ginn Physical Science and Life Science

(22b) TABLE 7.5

TEACHERS' OVERALL RATING OF TEXTS AND LABORATORY MANUALS USED

Rating	Frequency of Response	Percentage of Response (%) (n=299)
Very suitable	8	3
Suitable	36	12
Somewhat suitable	101	34
Unsuitable	121	40
No response	33	11

Teacher responses to items 22a and 22b were compared to produce an individual text rating shown in table 7.6.

(22a)-(22b) TABLE 7.6

TEACHERS'RATINGS OF TEXTS AND LABORATORY MANUALS USED

Text or Laboratory Manual	Frequency and Percentage Response				
	Very Suitable	Suitable	Somewhat Suitable	Un-suitable	No Response
Introducing Science Concepts in the Laboratory	4 (3)	17 (11)	57 (37)	67 (44)	7 (5)
Developing Science Concepts in the Laboratory	3 (2)	17 (12)	59 (40)	58 (40)	9 (6)
Extending Science Concepts in the Laboratory	2 (1)	11 (8)	50 (38)	64 (48)	6 (5)
Pathways in Science (Oxenhorm)	2 (6)	6 (20)	17 (55)	5 (16)	1 (3)
Invitations to Investigate Science (Wong)	1 (7)	3 (22)	8 (57)	2 (14)	0 (0)
Others	4 (4)	16 (16)	37 (37)	35 (35)	8 (8)

Seventy-four percent of respondents said that the texts and laboratory manuals they were using were only somewhat suitable to unsuitable for teaching science to limited success students (table 7.5). Table 7.6 shows that the majority of these poorly rated texts and laboratory manuals are those suggested and supplied by the B.C. Ministry of Education. Teacher comments suggested the following reasons for rating the texts and laboratory manuals in the way they did:

- reading level is inappropriate for limited success students (some say this is true for most students)
- concepts and instructions are too difficult
- content boring, irrelevant and too academic
- some texts (e.g. Concepts and Challenges in Science) are insulting to students' intelligence
- Reading About Science texts are not related to laboratory work
- text layout is dull, more diagrams are needed

While a majority of respondents reported the use of the science texts suggested by the Ministry of Education and the associated curriculum (tables 7.3 and 7.4) it seems evident that most teachers rate these texts (and indirectly the closely related curriculum) poorly (tables 7.5 and 7.6). These results imply the need for a new curriculum in science.

Table 7.7 shows the extent to which teachers of limited success students use various means to determine science course content for these students.

(23) TABLE 7.7[1]

SCIENCE COURSE CONTENT DETERMINATION FOR LIMITED SUCCESS STUDENTS

Proportion of Course	Frequency and Percentage Response						
	Based on Student Interest (n=299)	Based on Student Choice (n=299)	Based on Job-Oriented Science (n=299)	Based on Content Reduction (n=299)	Based on Reduction of Complexity (n=299)	Based on Core Curriculum (n=299)	Based on an Alternative Sequential Program (n=299)
None of the course	62 (21)	159 (53)	140 (47)	58 (19)	56 (19)	19 (6)	131 (44)
Less than half the course	120 (40)	76 (26)	93 (31)	60 (20)	58 (19)	29 (10)	48 (16)
About half the course	46 (16)	7 (2)	13 (4)	53 (18)	45 (15)	74 (25)	32 (11)
More than half the course	19 (6)	1 (<1)	6 (2)	42 (14)	35 (12)	65 (22)	10 (3)
Almost all the course	9 (3)	2 (1)	3 (1)	42 (14)	63 (21)	73 (24)	22 (7)
No response	43 (14)	54 (18)	44 (15)	44 (15)	42 (14)	39 (13)	56 (19)

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[1] The results of item twenty-three above show a relatively high non-response. This non-response is possibly due to teachers neglecting to circle the zero option of this item.

Only 29% of respondents said that they based a portion of their science course for limited success students on student choice. Sixty-five percent reported that they did use student interest to provide some basis for their science course. Apparently few teachers allow their limited success students significant decision making powers in course content determination. However, a majority (65%) seem to see a need to work from student interests in their curriculum planning.

The use of science course content reduction and a reduction of content complexity appears to be wide-spread. Forty-six and 48% of respondents reported that one-half or more of their course was based on a reduction of content or complexity.

Few teachers (7%) reported that one-half or more of their science course for limited success students was based on job-oriented science.

Seventy-one percent of all respondents reported basing one-half or more of their science course for limited success students on the present B.C. Core Curriculum. Only 21% of respondents said they used an alternative structured sequential program as a basis for one-half of their course or more.

Teacher comments related to science programs

Teachers' comments indicated their desire for changes in the present science curriculum specifically oriented towards limited success students. The comments of these teachers outlined the following areas of need:

- a need for variety requires a modular approach
- a need for a simple structured text with diagrams to supplement laboratory text
- a need to dilute the existing course
- a need for a highly structured program with short steps
- a need for programmed learning and fill-in-the-blanks worksheets
- a need to modify the existing program on an individualized basis
- a need for an appropriate reading level, writing to be kept to a minimum and less mathematical emphasis
- a need for a hands on approach including a more general laboratory manual and text book
- a need for a more individualized program.

Approaches to learning

Table 8.1 outlines the responses of teachers indicating the frequency that they involve their limited success students in a variety of approaches to learning.

(24) TABLE B.1[1]

FREQUENCY OF INVOLVEMENT OF LIMITED SUCCESS STUDENTS IN VARIOUS APPROACHES TO LEARNING

Frequency of Involvement	Frequency and Percentage Response							
	Teacher Arranged Experiments (n=299)	Discovery Method Experiments (n=299)	Small Group-Individualized Learning (n=299)	Project Approach (n=299)	Lecture and Notes (n=299)	Worksheets (n=299)	Class Discussion (n=299)	Audio-Visual Aids (n=299)
Never	3 (1)	40 (13)	115 (39)	79 (26)	17 (6)	34 (11)	2 (1)	10 (3)
Once or twice a term	11 (4)	58 (19)	64 (21)	143 (48)	30 (10)	60 (20)	28 (9)	37 (12)
Once or twice a month	36 (12)	70 (23)	46 (15)	39 (13)	72 (24)	116 (39)	55 (18)	131 (44)
Once or twice a week	166 (56)	69 (23)	23 (8)	10 (3)	128 (43)	57 (19)	121 (41)	89 (30)
Almost every class	63 (21)	34 (12)	22 (7)	3 (1)	31 (10)	12 (4)	71 (24)	15 (5)
No response	20 (7)	28 (10)	29 (10)	25 (9)	21 (7)	20 (7)	22 (7)	17 (6)

Frequency of Involvement	Frequency and Percentage Response				
	Demonstrations (n=299)	Field Trips (n=299)	Oral Presentations (n=299)	Review (n=299)	Programmed Learning (n=299)
Never	5 (2)	120 (40)	170 (57)	8 (3)	178 (60)
Once or twice a term	45 (15)	127 (43)	77 (26)	30 (10)	52 (18)
Once or twice a month	130 (44)	20 (7)	13 (5)	102 (34)	18 (6)
Once or twice a week	84 (28)	3 (1)	10 (3)	109 (36)	7 (2)
Almost every class	13 (4)	4 (1)	4 (1)	29 (10)	7 (2)
No response	22 (7)	25 (8)	25 (8)	21 (7)	37 (12)

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[1] The results of item twenty-four show a relatively high non-response. This non-response is possibly due to teachers neglecting to circle the zero option of this item.

Labwork. Seventy-six percent of respondents reported using teacher arranged labwork to instruct limited success students at least once or twice a week while only 35% said they use the discovery method to the same extent.

Small group and individualized learning. Sixty percent of all respondents reported that they never or rarely (once or twice a term) use a small group or individualized approach while 15% say they use this kind of approach at least once a week. The use of either of these approaches to learning to a major extent does not appear to be widespread in B.C. These results indicate a preference to whole class teaching a good deal of the time.

Project work. Twenty-six percent of respondents reported that they never involve their limited success students in project work during the school year. Given this significant proportion of respondents it is evident that many limited success students may not have the opportunity to chose a topic of interest to them which project work can facilitate.

Lecture and notes. Fifty-three percent of respondents reported that they use the lecture and notes approach at least once a week with their limited success students. These results support those related to small group and individualized learning.

Worksheets. Twenty-three percent of all respondents said that they use worksheets at least once or twice a week while 70% use worksheets once or twice a month or less to instruct their limited success students. Apparently worksheets are not in widespread use on a frequent basis for limited success science students in B.C.

Audio-visual aids. Thirty-five percent of respondents reported using audio-visual aids at least once a week while 59% said they use audio-visual aids once or twice a month or less to instruct their limited success students. The use of audio-visual aids, on a day-to-day basis, seems relatively rare among a majority of science teachers of limited success students.

Class discussion. Eighty-two percent of all respondents reported involving their limited success students in class discussion on at least a monthly basis. A further 76% said that they presented demonstrations with at least the same frequency as class discussions. Forty percent of all respondents said that they did not involve their limited success students in field trips. Evidently many limited success students are not exposed to the concrete experiences facilitated through a field trip.

Oral presentations. Thirty-five percent of respondents reported using oral presentations with limited success students while 57% said they never used this approach with these students. Since oral skills may work to enhance other communication skills it seems that many limited success students may not have the opportunity to improve these non-oral skills in their science classes.

Review. Eighty percent of respondents indicated that they reviewed once or twice a month or more when instructing limited success students. Forty-six percent said they review on a weekly or daily basis. Relatively frequent science review seems to be a common occurrence in the teaching of limited success students.

Programmed learning. Sixty percent of respondents said that they never used programmed learning to instruct their limited success students while 28% reported using this approach at least once or twice a term.

Further differences existing between teachers of homogeneously and heterogeneously grouped science classes

Some comparisons have already been made between the practices of teachers of homogeneously and heterogeneously grouped science classes. Further differences in both content determination and approaches to learning were evident between these two groups of teachers. Upon comparison of teaching methods with type of grouping it was found that a significantly greater percentage (in excess of 10%) of teachers of heterogeneously grouped science classes reported using the laboratory texts suggested by the Ministry of Education than did teachers of homogeneously grouped classes.

Teachers of homogeneously grouped classes reported using both student choice and student interest to determine course content to a greater extent than did teachers of heterogeneously grouped classes.

Teachers of homogeneously grouped science classes reported reducing content and complexity of course content for limited success students to a greater extent than did teachers of heterogeneously grouped classes.

Teachers of heterogeneously grouped science classes reported using the core curriculum to a greater extent than did teachers of homogeneously grouped science classes.

Teachers of heterogeneously grouped science classes reported using a lecture and notes approach to a greater extent than did teachers of homogeneously grouped science classes.

It is apparent that more freedom of choice is experienced by both teachers and students of homogeneously grouped science classes. More attention appears to be paid to the interests of the students in homogeneous classes than heterogeneous classes. Evidently reducing content and complexity of a course for limited success students is more common in homogeneously than heterogeneously grouped science classes.

Evaluation and reporting

Tables 9.1 to 9.4 outline teachers' responses to questions related to the evaluation and reporting of the progress of their limited success students. Table 9.1 reports on the extent of student involvement in evaluation. Table 9.2 reports the major areas in which limited success students are evaluated. Table 9.3 shows the extent to which testing is used when instructing limited success students. Table 9.4 shows the usage of the various methods of reporting student progress.

(26a) TABLE 9.1[1]

EVALUATION OF THE PROGRESS OF LIMITED SUCCESS STUDENTS

Evaluator(s)	Frequency of Response	Percentage of Response (%) (n=299)
Teacher only	132	44
Mainly by teacher, partially by student	21	7
Equally by student and teacher	0	0
Mainly by student, partially by teacher	0	0
Student only	0	0
Other	1	<1
No response	145	49

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[1] Item twenty-six had a high incidence of non-response. An error of numbering following item 25a resulted in the lack of teacher response to this item.

Eighty-six percent of respondents reporting on the evaluation of student progress stated that this evaluation was based solely on the teacher while 14% indicated some limited success student involvement in their own evaluation.

(26b) TABLE 9.2 *

COMPONENTS USED TO EVALUATE LIMITED SUCCESS STUDENTS

Evaluation Component	Frequency and Percentage Response	
	Component Used	Component Not Used
Student laboratory write-ups	145 (93)	11 (7)
Projects	99 (63)	57 (37)
Oral talks	44 (29)	111 (71)
Tests	141 (90)	15 (10)
Attitude	102 (66)	53 (34)
Attendance	69 (44)	87 (56)
Other	35 (23)	120 (77)

Student laboratory write-ups and tests were reported to be used by the majority (93% and 90% respectively) of respondents answering this item (26b). Approximately 65% of respondents reported including components of attitude and project work in their evaluation of limited success students. Forty-four percent of respondents said that they included attendance in their assessment while less than 30% reported including oral talks or other forms of assessment. Most teachers appear to use two to three different evaluation components to assess the progress of their limited success students. Teachers also reported evaluation based on: worksheets and notebooks; participation in class; workhabits; student assignments and oral explanation to the teacher; a final exam on the core curriculum; effort; reading assignments; writing skills with long term learning and field work by students.

(24) TABLE 9.3

TESTING: FREQUENCY USED IN THE INSTRUCTION OF LIMITED SUCCESS STUDENTS

Frequency of Use	Frequency of Response	Percentage of Response (%) (n=299)
Never	14	5
Once or twice a term	40	13
Once or twice a month	180	60
Once or twice a week	41	14
Almost every class	4	1
No response	20	7

Seventy-five percent of respondents said that they tested with a monthly to daily frequency. This result seems to be consistent with the result reported in table 9.2 where testing was said to have a heavy emphasis in the overall evaluation of limited success students.

(26c) TABLE 9.4 *

FREQUENCY OF VARIOUS METHODS OF REPORTING PROGRESS OF LIMITED SUCCESS STUDENTS

Reporting Method	Frequency of Response	Percentage of Response (%) (n=299)
Formal letter grades (A,B,C,D,E)	150	50
Satisfactory/unsatisfactory	12	4
Pass/fail/incomplete	19	6
Anecdotal	53	18
Other	15	5

Many teachers indicated the use of anecdotal reporting in conjunction with formal letter grades. Some of the other reporting schemes teachers reported were:

- complete/incomplete
- H (honours), S (satisfactory), S- (minimal pass) I (incomplete/fail)
- Pass/Fail used only in final report if mark is below a C+
- A,B,C,D/not mastered or incomplete
- C/Pass/Fail
- 1,2,3,4,5 scale 1 being the best

Further analysis of the data showed that formal letter grades were used by a larger proportion (16% more) of teachers of homogeneous than heterogeneous science classes.

Teacher attitudes and training

Tables 10.1 to 10.13 outline the training that respondents received related to limited success students and in addition examine some of the factors which may relate to the attitudes of these teachers.

(14) TABLE 10.1

TEACHERS OF HOMOGENEOUSLY GROUPED CLASSES: WILLINGNESS TO TEACH LIMITED SUCCESS STUDENTS IN HOMOGENEOUS CLASSES.

NUMBER OF CLASSES

Number of Classes	Frequency of Response	Percentage of Response (%) (n= 321)
0	51	16
1	33	10
2	10	3
3	4	1
4	1	1
5	0	
6	1	
7	1	
8	2	1
No Response	26	8
Totals	129	40

Forty-two percent of the teachers from homogeneously grouped class situations reported that they would be willing to teach at least one homogeneously grouped science class of limited success students. Forty percent of the teachers of homogeneously grouped classed indicated that they did not wish to teach these students in a special science class.

(21a) TABLE 10.2

TEACHERS OF HETEROGENEOUSLY GROUPED CLASSES:

POSITION ON ABILITY GROUPING

Position on Ability Grouping	Frequency of Response	Percentage of Response (%) (n=321)
Wish to group all limited success students	94	29
Do not wish to group limited success students	91	28
No response	9	3
Totals	194	60

(21b) TABLE 10.3

TEACHERS OF HETEROGENEOUSLY GROUPED CLASSES: DESIRE TO TEACH LIMITED SUCCESS STUDENTS SCIENCE IN A SEPARATE CLASS GROUP

Desire to Teach Limited Success Students in a Separate Class	Frequency of Response	Percentage of Response (%) (n=321)
Would teach these classes	64	20
Would not teach these classes	114	36
No response	1	4
Totals	194	60

(21c) TABLE 10.4

TEACHERS OF HETEROGENEOUSLY GROUPED CLASSES: WILLINGNESS TO TEACH LIMITED SUCCESS STUDENTS IN HOMOGENEOUS CLASSES. NUMBER OF CLASSES

Number of Classes	Frequency of Response	Percentage of Response (%) (n=321)
0	78	24
1	64	20
2	32	10
3	6	2
4	0	0
No response	14	4
Totals	194	60

About one-half (49%) of the teachers of heterogeneously grouped science classes indicated their desire to group limited success students into a separate science class (table 10.2). Fifty-nine percent of these teachers also said that they would not choose to teach these separate classes of limited success students (table 10.3). Fifty-three percent said that they would be willing to teach at least one class of separately grouped limited success students (table 10.4).

In order to interpret teachers' position an ability grouping more clearly the results of tables 10.2 and 10.3 have been compared and reported in table 10.5 which shows four possible positions teachers may hold regarding ability grouping.

(21a)-(21b) TABLE 10.5

TEACHERS OF HETEROGENEOUSLY GROUPED CLASSES:
DESIRE TO GROUP AND TEACH LIMITED SUCCESS SCIENCE
STUDENTS IN A SEPARATE CLASS

Teachers' position	Frequency of Response	Percentage of Response (%) (n=321)
Would group and teach limited success students	45	14
Would group but not teach limited success students	48	15
Would not group but would teach separate groups of limited success students	19	6
Would not group and not teach separate groups of limited success students	66	21
No response	16	4
Totals	194	60

Twenty-nine percent of respondents indicated that they would group limited success students into separate classes for science instruction. About half of these teachers in favour of ability grouping reported that they were willing to teach these classes. Sixty percent of teachers of heterogeneously grouped classes said they would not be willing to teach limited success science students in a separate class group.

By combining the results of tables 10.1 and 10.4 a partial picture of teacher commitment to teaching limited success students may be generated (table 10.6).

TABLE 10.6

TEACHER COMMITMENT TO TEACHING LIMITED SUCCESS STUDENTS

Commitment	Frequency of Response	Percentage of Response (%) (n=321)
Show a desire to teach limited success students	116	36
Prefer not to teach limited success students	48	15
Not analysable	117	37
No response	40	12

The 117 respondents not analysable were those teachers in table 10.1 who indicated that they did not wish to teach any separate classes of limited success students plus those teachers in table 10.5 who said they would not group or teach limited success students in a separate class. The results indicate that a significant number of B.C. junior secondary science teachers do not hold a commitment to teaching limited success students.

(13) TABLE 10.7 *

METHOD OF TEACHER ASSIGNMENT TO HOMOGENEOUSLY GROUPED CLASSES OF LIMITED SUCCESS SCIENCE STUDENTS

Method of Assignment	Frequency of Response	Percentage of Response (%) (n=321)
Own choice	35	11
Science department decision	27	8
Assignment by department head	16	5
Assignment by principal	59	18
Other	15	5

Most teachers checked only one of the methods listed in table 10.7. The results show that teachers report that assignments to specially grouped science classes for limited success students are made by either the principal or department head (23%). By considering only those teachers of homogeneously grouped science classes the proportion increases to 68%. Only 11% of all respondents (28% of teachers in homogeneous grouping situations) report having the option to teach these classes. The list below presents some of the alternate methods of assignment reported by respondents:

- assignment on a rotational basis by science teachers
- assignment by counsellor recommendation
- assignment by random time tabling
- assignment by vice-principal

Teachers were asked to report the number of separate science and non-science classes that they taught. In addition the total number of blocks in teachers' timetables was reported. Using these two figures it was possible to determine what free time teachers had available per timetable cycle (table 10.8).

(6) TABLE 10.8

FREE TIME OF JUNIOR SECONDARY SCIENCE TEACHERS

Number of Classes Per Cycle	Frequency of Response	Percentage of Response (%) (n=299)
0	32	11
1	172	58
2	27	9
3	13	4
Miscellaneous	36	12
No Response	19	6

Fifty-eight percent of respondents reported one spare class per timetable cycle while 11% said they did not have any free time. Thirteen percent had two to three spare classes per cycle. Thirty-six respondents (12%) obviously misinterpreted the nature of item six and so were classified as miscellaneous in table 10.8.

(2a) TABLE 10.9

PRE-SERVICE TEACHER TRAINING RELATED TO LIMITED SUCCESS STUDENTS

Pre-Service Training	Frequency of Response	Percentage of Response (%) (n=299)
Have received pre-service training	64	21
Have not received pre-service training	233	78
No response	2	1

(2b) TABLE 10.10

EXTENT OF PRE-SERVICE TEACHER TRAINING RELATED TO LIMITED SUCCESS STUDENTS

Amount of Pre-Service Training	Frequency of Response	Percentage of Response (%) (n=299)
A whole course	15	5
Half a course	4	1
A few hours of a course	23	8
An hour of a course	1	<1
Incidentally during a course	18	6
No response	3	1

(2c) TABLE 10.11

TEACHERS' RATING OF PRE-SERVICE TEACHER TRAINING RELATED TO LIMITED SUCCESS STUDENTS

Rating	Frequency of Response	Percentage of Response (%) (n=299)
Very useful	4	1
Of some use	41	14
Of little use	15	5
Of no use	1	<1
No response	3	1

The results in table 10.9 show that 78% of respondents reported no previous training related to limited success students. Of the teachers who did report some special training (only 21%) 30% said they received a whole course or half a course related to these students. The balance of these teachers with special training (69%) reported receiving a few hours or less of this training (table 10.10). Seventy percent of teachers who did receive prior training indicate that this training was at least of some use to their subsequent teaching of limited success students (table 10.11).

(5a) TABLE 10.12

IN-SERVICE TEACHER TRAINING RELATED TO LIMITED SUCCESS STUDENTS

In-service Training	Frequency of Response	Percentage of Response (%) (n=299)
Has been provided	57	19
Has not been provided	242	81

(5b) TABLE 10.13

TEACHERS' RATING OF IN-SERVICE TRAINING

Rating	Frequency of Response	Percentage of Response (%) (n=299)
Very useful	5	2
Useful	40	13
Of little use	9	3
Of no use	3	1
No response	242	81

Most teachers (81%) reported that they did not receive in-service training related to limited success students (table 10.12). Of the teachers who said they did receive some special in-service training 77% reported that they had found this training to be at least of some use (table 10.13).

The results outlined in this chapter have suggested a number of conclusions and recommendations which are presented in the following chapter.

CHAPTER 3

Conclusions and Recommendations

Introduction

This chapter presents the major conclusions and recommendations derived from the survey. Conclusions and recommendations were only generated on the basis of (1) 10% or more respondents reporting under one option of a questionnaire item or (2) where a difference of 10% or more responses existed between the options of a questionnaire item. The same 10% level was used when bivariate comparisons were made between questionnaire items. The use of 10% as a guideline was based upon this percentage as the lower limit for the acceptance of a problem area as having educational significance.

This chapter is divided into two sections, the first section details the results and discussion leading to the conclusions and section two details the results and discussion leading to the recommendations also listed in this section.

Since all conclusions and recommendations are based on teacher perception and not validated observation caution must be exercised before acceptance, rejection or implementation of the findings.

Conclusions

Forty-seven percent of respondents reported the proportion of limited success students in their science classes to be in excess of 20% (table 4.3). Forty-two percent of respondents said that they taught limited success science students in homogeneously grouped classes (table 6.1). A further 21% of teachers reported some form of grouping within their heterogeneously grouped classes (table 6.3). In total 63% of respondents reported using some form of ability grouping for the limited success students they taught. The numbers of limited success students reported and the widespread attempt to deal with these students indicates both the significant size of this population and a general awareness of its existance.

Twenty-five percent of respondents reported using a special program to teach their limited success science students (table 7.1). The remaining teachers said they used the curriculum and laboratory texts presently suggested by the Ministry of Education[1] (tables 7.3, 7.4 and 7.7).

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[1] Curriculum guides: British Columbia Ministry of Education Junior Science Curriculum Guides - Grade 8, Grade 9, Grade 10, 1970.

Laboratory texts: Manfred C. Schmid,ed., Extending Science Concepts in the Laboratory (Scarborough: Prentice-Hall of Canada, 1970). Walter H.Rasmussen and Manfred C.Schmid, eds.,Developing Science Concepts in the Laboratory (Scarborough: Prentice-Hall of Canada, 1968). Manfred C.Schmid,ed.,Introducing Science Concepts in the Laboratory (Scarborough: Prentice Hall of Canada, 1973).

An average of 82% of respondents reported that these laboratory texts were only somewhat suitable to unsuitable for the instruction of limited success science students (table 7.6). Teacher comments (in chapter two) further indicate additional drawbacks of the present curriculum and the need and desire for an appropriate new curriculum for these students.

Based on the data collected three major conclusions can be drawn:

1. A significantly large population of limited success students exist in B.C. junior secondary schools
2. A general awareness of the existence of a population of limited success students in B.C. is evident
3. Few special science programs have been developed for limited success students in B.C. Most junior secondary science teachers perceive the present recommended curriculum to be largely inappropriate for instructing limited success students

Recommendations

Curriculum

Only one quarter (25%) of respondents reported the development of a special science program for their limited success students (table 7.1). Of the teachers reporting special programs 14% were teachers of homogeneously grouped science classes (33% of all homogeneous teachers) while 8% were teachers of heterogeneously grouped science classes (table 7.2). The majority of respondents reported the use of the curriculum and associated laboratory texts suggested by the Ministry of Education (tables 7.3, 7.4 and 7.7). An average of 82% of respondents reported that the suggested laboratory texts (and the closely related curriculum) were only somewhat suitable to unsuitable for the instruction of limited success science students (table 7.6). From 5% to 33% of respondents reported using other curricula and sources than those suggested by the Ministry of Education (tables 7.4 and 7.7), however these alternative curricula were not rated more suitable than the recommended curriculum (table 7.6). Forty-six percent of respondents reported that at least one-half of their science course for limited success students was based on reduced content compared to other students, while 48% reported that subject matter of reduced complexity comprised at least one-half of their science course for limited success students (table 7.7). Fifty-three percent of respondents said they did not base any portion of their science course for limited success students on student choice (table 7.7). Twenty-one percent said they did not base any portion of their science course for these students on student interests.

The literature indicates that effective teaching within ability grouping requires that appropriate materials and curriculum be provided to each ability level (Ekstrom 1961, Thomas and Thomas 1975, Passow 1966). The lack of specially developed science programs in B.C., the adherence to the existing texts and curriculum and the respondents' lack of faith in the existing curriculum indicates a major variance with the suggestions of the literature. Two major curriculum approaches for limited success science students in B.C. appear to be reduction of course content and complexity compared to other students. The literature indicates the inappropriateness of such a diluted curriculum (Johnson 1963, Ladd 1972, Collette 1973, Sturges 1973, Younie 1974). The fact that many teachers say they modify or reject the existing curriculum indicates a concern among teachers regarding the adequacy of this curriculum. Allowing students choice within a curriculum, basing part of a curriculum on students' interests and the job-oriented aspects of science is said to help improve the self-concept of limited success students and provide them with a more relevant and motivating curriculum (Newsom 1963, Larlin and Berger 1969, Webster 1970, Tisher et al. 1972, Kelly 1974, Sturges 1976, Wragg 1976). The lack of student involvement in curriculum determination indicates a less student-centered approach to learning as compared to the recommendations in the literature.

1. It is recommended that a new science curriculum be developed which reflects the wide ability range of B.C. junior secondary students in general and limited success students in particular.

Teachers and school administration

Teachers' science background. Nine percent of all respondents reported a non-science undergraduate background (table 1.1). The literature suggests that teachers of limited success students should have expertise in science rather than being generalists. Accordingly students will benefit from a teachers' expertise in one area (Kelly 1974).

2. It is recommended that teachers with science background be chosen to teach science at the junior secondary level.

Teaching experience. Fifty-one percent of teachers who had previous experience with homogeneously grouped classes of limited success science students reported that they first taught these classes in their first or second year of teaching (table 2.3). The literature indicates that often the least experienced teachers are assigned to instruct classes of homogeneously grouped limited success students (Sturges 1976). In choosing teachers of homogeneously grouped limited success science classes it is not evident that teachers with some experience are selected for these assignments.

3. It is recommended that teachers with some teaching experience be assigned to teach special science classes for limited success students.

Teacher commitment. At least 15% of respondents indicated that they would be willing to group limited success students for science but were not willing to teach these classes (table 10.5). Thirty-six percent said that they would be willing to instruct these students under any grouping circumstances (table 10.6).

Sixty percent of respondents who taught homogeneously grouped science classes said that they were assigned to these classes by a Principal or department head. Only 28% of these teachers said they chose to teach such classes (table 10.7). Eleven percent of respondents reported that they did not have any spare class time during the week (table 10.8).

The literature states that teachers of limited success students should be committed to teaching these students (Featherstone 1951, Johnson 1963, Ausubel 1967, Reissman 1969, Glasser 1971, Younie 1974). Teacher reports indicate that a significant proportion of B.C. junior secondary science teachers do not appear to be committed to instructing these students. The literature also states that the instruction of limited success students is difficult and time consuming, requiring adequate preparation time (Kelly 1974). Evidently a significant number of B.C. junior secondary science teachers do not have spare time.

4. It is recommended that teachers be assigned to classes of homogeneously grouped limited success students only if they hold a commitment to teaching these students. It is further recommended that teachers be assigned to heterogeneously grouped classes only if they hold a commitment to teaching students of a wide ability range.

5. It is recommended that teachers be given some choice in the classes they teach and adequate spare time for preparation.

Class size. Eighty percent of teachers of homogeneously grouped science classes reported class sizes of twenty-five students or less while 11% reported class sizes in excess of twenty-five students (table 6.4). Approximately 38% of teachers of both homogeneously grouped non-limited success students and heterogeneously grouped classes reported class sizes of twenty-five students or less.

The literature recommends that all science classes, whether homogeneously or heterogeneously grouped, should not exceed twenty-five students (Oxenhorn 1972, Younie 1974). Although the majority of homogeneously grouped science classes for limited success students in B.C. fall within the suggested guidelines of the literature, 11% still maintain a class size of twenty-six students or more. The majority of heterogeneously grouped science classes and homogeneously grouped classes for non-limited success students seem to exceed the suggestions in the literature.

6. It is recommended that all science classes be reduced to twenty-five students and in particular homogeneously grouped science classes for limited success students.

Student evaluation. Eighty-six percent of respondents reporting on the evaluation of limited success science students indicated that evaluation was determined solely by the teacher while only 14% reported minimal student involvement (table 9.1). Most teachers reported using tests (90%) and student laboratory write-ups (93%) to evaluate their limited success students, while fewer used projects (60%), student attitude (66%), student attendance (44%), oral talks (29%) and other evaluation components (23%) (table 9.2). Seventy-five percent of teachers reported that they tested with a frequency of at least once or twice a month (table 9.3).

The literature indicates that student involvement in decision making may improve student self-concept, help remove student feelings of hopelessness and fatalism and, by participating in their own evaluation, give an opportunity for realistic self-evaluation (Newsom 1963, Scottish Education Department 1969, Ladd 1972, Sturges 1973, Younie 1974, Sturges 1976, Wragg 1976). A wide evaluation base is advocated to provide both a broad picture of student progress and to ensure that a student has an opportunity to do well at something congruent with his learning style (Hughes 1973). By testing frequently (and in general evaluating frequently) the student is made aware of his strengths and weaknesses which may be built upon or remediated as necessary (Darke 1976).

The survey results indicate that it is a rare occurrence where teachers relinquish the responsibility of evaluation to students. Evaluation of limited success students in B.C. science classes seems to be based upon only two or three different components. Although these components include both cognitive and affective (attitude) areas it would seem that a narrow base of evaluation is inadequate to evaluate the potential of any student.

7. It is recommended that teachers increase the number of components they use to evaluate the progress of their limited

success students and include more opportunities for students to evaluate their own work and progress.

Teacher training

Pre-service training. Twenty-one percent of respondents reported taking some pre-service training related to limited success students (table 10.9). Thirty percent of these teachers said they took a half course or more while 70% reported that they experienced a minimal amount (a few hours or less) of special training (table 10.10). Seventy percent of teachers who experienced some pre-service training said that this training was of some use to their subsequent teaching of limited success students (table 10.11).

The literature suggests that pre-service training should include some components related to limited success students (Schools Council 1970, Schools Council 1971, Kelly 1974, Schools Council 1975, Sturges 1976). Since it seems that few B.C. junior secondary science teachers have had little, if any, pre-service training in this area, it is likely that they will take some time to acquire the skills of teaching these students.

8. It is recommended that a required course or portion of a course, related to limited success students, be included in the pre-service training of science teachers.

In-service training. Less than one-fifth (19%) of respondents reported having received any in-service training related to limited success students (table 10.12). Seventy-seven percent of these teachers said that this training was of some use to their teaching of limited success students (table 10.13). Since little pre-service training was reported it is surprising that more compensatory in-service training has not been provided.

9. It is recommended that in-service training related to limited success students be increased.

Approaches to learning. Eighty-eight percent of respondents reported using a directed inquiry approach (teacher directed experiments) at least once or twice a month (table 8.1). Only 58% reported using a discovery approach as frequently (table 8.1). Forty percent of respondents reported that they never involved their limited success students in field trips (table 8.1) and 76% said they utilized class demonstrations at least once or twice a month (table 8.1). Thirty-five percent of respondents reported that they used audio-visual aids frequently (at least once or twice a week) while 59% reported less frequent use (once or twice a month or less) (table 8.1). Thirty-nine percent of respondents reported that they never used a small group or individualized approach and over one-half (53%) said they used the lecture and notes approach frequently (at least once or twice a week) (table 8.1). Worksheets were reported to be used at a maximum of once or twice a month by 70% of respondents and at least once or twice a week by only 23% of respondents (table 8.1). Forty-six percent of respondents reported the use of frequent review (at least once or twice a week) (table 8.1) and 60% said they never used programmed learning (table 8.1). Seventy-one percent of respondents said they involved their limited success students in class discussion at least once or twice a month (table 8.1), however, 97% reported they never involved these students in oral presentations (table 8.1). Twenty-six percent of respondents said they never used the project approach in the instruction of limited success science students (table 8.1).

The literature advocates that limited success students should learn by concrete experience (Featherstone 1951, Johnson 1963, Newsom 1963, Reissman 1969, Younie 1974, Sturges 1976). Laboratory work, field trips and demonstrations are seen to help provide these concrete experiences. Audio-visual aids are thought to be an extension to concrete learning experiences and help provide alternate modes of learning to allow for students' diverse learning styles (Featherstone 1951, Ausubel 1965, Bloom 1966, Webster 1970, Jenkins et al. 1973, Kelly 1974, Younie 1974, Sturges 1976). Individual and small group learning is said to help the teacher to deal more individually with the students, resulting in better teacher-student relationships, improved individual attention to allow for student differences and a more indirect teaching style (Scottish Education Department 1969, Milson 1970, Schools Council 1970, Collette 1973, Hughes 1973, Darke 1976, Sturges 1976, Wragg 1976). The use of worksheets (especially in a small group or individualized learning) is advocated to free the teacher to deal with students on an individual basis, to allow students to proceed at a pace congruent with their ability and to prevent needless student note-taking (Newsom 1963, Kamm 1969, Jenkins et al. 1973, Schools Council 1976, Darke 1976, Sturges 1976). Since limited success students lack successful experiences in school the provision of a directed inquiry approach, frequent review and supplemental programmed learning are thought to help provide short steps learning with prearranged, but non-trivial, success (Reissman 1969, Webster 1970, Texas Education Agency 1972, Wilkenson and Bowers 1976, Ausubel 1967, Jenkins et al. 1973, Collette 1973, Sturges 1976). Students' communication, in other than oral modes, is thought to be promoted by both oral presentations and class discussion. These oral approaches are also considered to be useful for the limited success student who is a poor reader and/or writer (Newsom 1963, Tuckman 1969, Karnes 1970, Oxenhorn 1972, Kelly 1974, Sturges 1976). Student projects are said to provide the student with both relevance and the opportunity to make decisions regarding a portion of his science course (Newsom 1963, Thomas and Thomas 1965, Collette 1973, Kelly 1974, Schools Council 1975, Sturges 1976).

While it appears as if some B.C. junior secondary science teachers are involved in all approaches discussed above it is apparent that a significant percentage of respondents do not involve their limited success students in the following approaches: small group or individualized learning; student projects; worksheets (on a weekly basis); frequent use of audio-visual aids; field trips; oral presentations and frequent review (at least once or twice a week).

10. It is recommended that pre-service and in-service training include instruction on the methods necessary to facilitate student involvement in: small group and individualized learning; project work; oral presentations and review. This training should encourage teachers to use and/or produce appropriate audio-visual aids, worksheets and programmed learning.

Ability grouping. Sixty-three percent of respondents reported the existence of some form of ability grouping in their science classes (tables 6.1 and 6.3). Forty-two percent reported homogeneously grouped science classes for limited success students (table 6.1). Twenty-one percent said they grouped occasionally within their heterogeneously grouped science classes (table 6.3).

Forty percent of the teachers of homogeneously grouped science classes reported that they would teach at least one class of separately grouped limited success science students (table 10.1). Fifty-three percent of the teachers of heterogeneously grouped science classes reported that they were willing to teach at least one of these classes (table 10.4). Nearly one-half (49%) of teachers of heterogeneously grouped science classes wished to group all limited success students into separate science classes (table 10.2).

While there is no conclusive evidence in support of the effectiveness of either homogeneous or heterogeneous ability grouping, the latter practice is the most favoured in the recent literature (Esposito 1973, Davies 1975, Findlay and Bryan 1975, Wilson and Schmits 1978). Although the practice of ability grouping in B.C. is significantly less than indicated in the literature it is evident that the practice is still favoured in many B.C. junior secondary schools. The types of grouping occurring in heterogeneously grouped classes (see chapter two) indicate that a variety of methods is used with no consistent province-wide pattern evolving.

The expressed willingness of many teachers to teach separate classes of limited success students and the stated desire of many respondents for specially grouped science classes indicates a large body of teacher acceptance of ability grouping. Presently in B.C. there appears to be mismatch between what teachers think and the position advocated in the literature on ability grouping.

11. It is recommended that debate and discussion be stimulated on the current status of research and educational thinking on ability grouping.

12. It is also recommended that pre-service and in-service training provide instruction in appropriate methods of grouping within heterogeneous classes.

Further research

Composition of the limited success student population. Twenty-five percent of respondents reported that well over half of their limited success students were boys while only 4% reported that well over half were girls (table 5.1). This higher proportion of male limited success students is reported by teachers of both heterogeneously and homogeneously grouped science classes. The imbalance of boys and girls is also noted in the literature but little explanation is forwarded for its occurrence (Bricklin and Bricklin 1967). It seems desirable that further investigation be carried out in this area.

13. It is recommended that research be carried out to help identify some of the causal factors underlying the higher proportion of male limited success students.

Once these factors have been identified it will then be possible to develop appropriate measures to reduce the overall numbers of limited success students and in particular the number of boys in this category.

Inter-group transfer in homogeneous ability grouping. Less than one-fifth (18%) of respondents reported that any of their homogeneously grouped limited success students advanced to a higher ability group at the same grade level (table 6.2). This lack of inter-group transfer is also alluded to in the literature (Davies 1975). Two interpretations of this reduced upward mobility are possible: the nature of present systems of grouping may be too inflexible to allow mobility of limited success students or the students themselves may progress very little and thus not warrant inter-group transfer.

14. It is recommended that further research be conducted to determine the causal factors underlying the tendency for limited success students to remain in special science classes.

Increase of limited success students with higher grade level. Of the teachers reporting homogeneously grouped science classes 26% reported grouping in grade eight, 32% reported grouping in grade nine and 42% reported grouping in grade ten (table 4.1). It is evident that there is an increase in the incidence of special grouping with higher grade level. The increase in the number of special science classes indicates an increasing population of limited success students with higher grade level. The nature and causes of the increase with grade level is not known at this time.

15. It is recommended that further investigation be initiated to determine the causal factors underlying the reported increase of limited success science students with increasing grade level.

Limited success student identification in homogeneously grouped classes. Six percent of teachers of homogeneously grouped science classes reported that 20% or less of their students were limited success students (table 4.1). Eighty percent of teachers of heterogeneously grouped science classes reported that 20% or less of their students were in the limited success category (table 4.2). Eighty-four percent of teachers of homogeneously grouped science classes reported that their classes were composed of 20% or more limited success students (table 4.1). Less than one-fifth of teachers of heterogeneously grouped science classes reported a limited success student population in excess of 20% (table 4.2). Homogeneous grouping seems to identify a greater proportion of limited success students than heterogeneous grouping.

16. _It is recommended that further investigation be conducted to determine the factors causing the higher incidence of limited success student identification in homogeneously grouped science classes compared to heterogeneously grouped science classes_.

Study Conclusion

Two hundred and ninety-nine junior secondary school science teachers responded to the questionnaire (82% of a sample of 336). A previously tested sampling frame was used. The high level of response and the tested sampling frame gave significant results and the data should provide a good basis for the consideration of appropriate curricula and teaching methods for limited success students in B.C. As with any survey, caution is urged before acceptance, rejection or implementation of the findings.

APPENDIX A

Questionnaire Format

The Limited Success Student* in Science:
A survey of current practices in junior secondary science in British Columbia

*For the purposes of this study limited usccess students are defined as:

a) those students achieving a consistent D or E average in science or

b) those students specially grouped for the purposes of science instruction due to previous low achievement.

In order to obtain a clear picture of current practices in B.C. junior secondary science for limited success students, we ask you for a few minutes of your time to complete this questionnaire.

The questionnaire has a branching pattern so this means you will not be required to do every page.

Your response is completely confidential. The number on this questionnaire is solely for follow-up purposes. The data obtained will be used only by the principal researcher and his advisor. Our report will consist only of group percentages and no identification of individual teachers, schools or school district will be made.

NOTE: Please check or circle the appropriate response for each item. On some items, more than one choice may be marked. Such items will be preceded by '(Multiple Response Item)'. All other items are to be responded to only once.

Please return the completed questionnaire in the self-addressed, pre-stamped envelope provided. The return of this questionnaire is requested by May 24, 1978.

LIMITED SUCCESS STUDENTS

Limited success students are defined as:

a) those students achieving a consistent D or E average (or equivalent rating) in science or

b) those students specially grouped for science instruction due to their low achievement.

PLEASE PROVIDE THE FOLLOWING BACKGROUND INFORMATION

1. (Multiple Response Item)

a) Please check your undergraduate major(s) or concentration(s).

biology . . . . ☐
chemistry . . . . ☐
physics . . . . ☐
earth science . . . . ☐
space science . . . . ☐
other (please specify) . . ☐ ______________

b) (Multiple Response Item)

Higher degrees

no higher degree . . . . . ☐
M.Sc. . . . . ☐
M.A.. . . . . ☐
M.Ed. . . . . ☐
Ph.D. (or equivalent) . . . ☐
Other (please specify). . . ☐ ______________

2. a) Did you receive **any** instruction in the teaching of limited success students at your teacher training institution?

Yes ☐ No ☐ (if No please proceed to question 3)

b) Since you received special instruction at your teacher training institution, approximately **how much** instruction was provided?

- a whole course. . . . . ☐
- half a course . . . . ☐
- a few hours of a course . . . . . ☐
- an hour of a course . . . . ☐
- incidentaly during a course . . . ☐

c) Since you received special instruction at your teacher training institution, **how useful** has this instruction been to your teaching?

- very useful . . . . ☐
- of some use . . . . ☐
- of little use . . . . ☐
- of no use . . . . ☐

3. In what year of your teaching career are you at **present**?

- first . . . . ☐
- second or third . . . . ☐
- fourth to ninth . . . . ☐
- tenth or over . . . . ☐

4. a) Have you taught junior science (grade 8, 9 or 10) to limited success students **in a separate class group**, at any **previous** time in your teaching career?

Yes ☐ No ☐ (if No please proceed to question 5)

b) Since you have taught junior science to limited success students in separate class groups, in what year of your teaching career did you **first** teach these students?

- first . . . . ☐
- second . . . . ☐
- third . . . . ☐
- fourth . . . . ☐
- fifth or above . . . ☐

5. a) Have you attended any in-service training to assist you in teaching limited success students?

Yes ☐ No ☐ (if No please proceed to question 6)

b) Since you have received some in service training how useful has this training been to your teaching?

very useful . . . . ☐
of some use . . . . ☐
of little use . . . . ☐
of no use . . . . ☐

6. a) What grades are taught in your school?

K 1 2 3 4 5 6 7 8 9 10 11 12

b) What is the total student population of your school?

less than 200 . . . . ☐
200 - 400 . . . . ☐
400 - 600 . . . . ☐
600 - 800 . . . . ☐
800 -1000 . . . . ☐
1000 -1200 . . . . ☐
More than 1200 . . . . ☐

c) How many separate classes in all subject areas do you presently teach?

1 2 3 4 5 6 7 8 9

d) What is the total number of separate blocks in your timetable?

1 2 3 4 5 6 7 8 9 10

7. (Multiple Response Item)

Please check the subject areas you presently teach in junior science.

	Science 8	Science 9	Science 10
physics	☐	☐	☐
chemistry	☐	☐	☐
biology	☐	☐	☐
earth science	☐	☐	☐
space science	☐	☐	☐
integrated*	☐	☐	☐
interdisciplinary**	☐	☐	☐
other (please specify). . . .	☐	____________________	

*integrated - disciplines of science (eg. chemistry and biology) merged to study themes of interest.

**interdisciplinary - subject areas other than science (eg. social studies) enter into the study of themes of a scientific nature.

8. Please indicate number of classes presently taught at each grade level.

Science 8	0	1	2	3	4	5	6	7	8
Science 9	0	1	2	3	4	5	6	7	8
Science 10	0	1	2	3	4	5	6	7	8

TO COMPLETE THIS QUESTIONNAIRE

PLEASE READ THE FOLLOWING

PRESENT TEACHING RESPONSIBILITIES

If your limited success students are grouped in separate classes for science instruction please proceed to Question 9 of this questionnaire.

If your limited success students are not grouped in separate classes for science instruction please proceed to Question 16 of this questionnaire.

LIMITED SUCCESS STUDENTS: SPECIALLY GROUPED DUE TO THEIR LOW ACHIEVEMENT

9. Of the junior science classes you teach how many are grouped specifically for limited success students?

Science 8	0	1	2	3	4	5	6	7	8
Science 9	0	1	2	3	4	5	6	7	8
Science 10	0	1	2	3	4	5	6	7	8

10. a) What is the average size of your classes for limited success students?

less than 16 . . . . . ☐
16 - 20 . . . . ☐
21 - 25 . . . . ☐
26 - 30 . . . . ☐
over 30 . . . . ☐

b) How is science presently timetabled for limited success students in your school?

regular or full year . . . . . . ☐
semestered . . . . ☐
quartered . . . . ☐
other (please specify) . . . . . ☐ __________________

c) Approximately how many hours of science per week are provided for your limited success students?

0 - 1 hour . . . . ☐
1 - 2 hours . . . . ☐
2 - 3 hours . . . . ☐
3 - 4 hours . . . . ☐
4 - 5 hours . . . . ☐
5 - 6 hours . . . . ☐
over 6 hours . . . . ☐

11. Of the limited success science students you teach what is the distribution of these students by sex?

all boys . . . . ☐
well over half are boys . . . . ☐
about half boys and half girls . . . . . . ☐
well over half are girls . . . . ☐
all girls . . . . ☐

12. Over the period of a year what proportion of your limited success science; students are promoted to a higher achieving group at the same grade level?

all . . . . ☐
well over half . . . . ☐
about half . . . . . . ☐
well under half . . . . ☐
none . . . . ☐

13. (Multiple Response Item)

How were you chosen to teach these limited success students?

own choice . . . . ☐
science department decision . . . . . ☐
assignment by department head . . . . ☐
assignment by principal . . . . ☐
other (please specify) . . . . ☐ ____________________

14. Given your choice and your present teaching load, how many classes of science for limited success students would you be willing to teach?

0 1 2 3 4 5 6 7 8

15. a) What is the average size of your non-limited success science classes?

less than 16 . . . . ☐
16 - 20 . . . . ☐
21 - 25 . . . . ☐
26 - 30 . . . . ☐
over 30 . . . . ☐

b) How is science presently timetabled for non-limited success students in your school?

regular or full year . . . . ☐
semestered . . . . ☐
quartered . . . . ☐
other (please specify) . . . . . . ☐ ____________________

c) How many hours of science per week are provided for your non-limited success students?

0 - 1 hour . . . . ☐
1 - 2 hours . . . . ☐
2 - 3 hours . . . . ☐
3 - 4 hours . . . . ☐
4 - 5 hours . . . . ☐
5 - 6 hours . . . . ☐
over 6 hours . . . . ☐

Comments related to this portion of the questionnaire: ____________

PLEASE PROCEED TO QUESTION 22

LIMITED SUCCESS STUDENTS:
NO SPECIAL GROUPING

16. What is the average size of your science classes?

- less than 16 . . . . ☐
- 16 - 20 . . . . ☐
- 21 - 25 . . . . ☐
- 26 - 30 . . . . ☐
- Over 30 . . . . ☐

17. Approximately what percentage of the science students you teach are limited success students?

- up to 10% . . . . ☐
- up to 20% . . . . ☐
- up to 33% . . . . ☐
- up to 50% . . . . ☐
- over 50% . . . . ☐

18. Of those students you consider to be limited success what is the distribution of these students by sex?

- all boys . . . . ☐
- well over half boys . . . . . . ☐
- about half boys and half girls . ☐
- well over half girls . . . . . . ☐
- all girls . . . . ☐

19. Do you group students according to their ability within your science classes?

Yes ☐ No ☐ Sometimes ☐

Comments ______________________________

20. a) How is science presently timetabled in your school?

regular or full year . . . . ☐
semestered . . . . ☐
quartered . . . . ☐
other (please specify) . . . . ☐ ____________________

b) Approximately how many class hours of science per week are provided for your junior science students?

0 - 1 hour . . . . ☐
1 - 2 hours . . . . ☐
2 - 3 hours . . . . ☐
3 - 4 hours . . . . ☐
4 - 5 hours . . . . ☐
5 - 6 hours . . . . ☐
over 6 hours . . . . ☐

21. a) Given the choice would you group all limited success students into separate classes for science?

Yes ☐ No ☐

b) Given the choice would you opt to teach these separate science classes for limited success students?

Yes ☐ No ☐

c) Given the choice and your present teaching load, how many separate classes of limited success students would you be willing to teach?

0 1 2 3 4 5 6 7 8

Comments related to this portion of the questionnaire ____________________
____
____
____
____

PLEASE TURN TO QUESTION 22

PLEASE PROVIDE THE FOLLOWING INFORMATION
ABOUT YOUR JUNIOR SCIENCE PROGRAM

22. a) (Multiple Response Item)

What text(s) or lab manual(s) do you use with your limited success students (grouped or ungrouped)?

Introducing Science Concepts in the Laboratory
(Schmid et al) . . . . ☐

Developing Science Concepts in the Laboratory
(Schmid et al) . . . . ☐

Extending Science Concepts in the Laboratory
(Schmid et al) . . . . ☐

Pathways in Science (Oxenhorn et al) . . . . . . ☐

Invitations to Investigate Science
(Wong et al) . . . . ☐

Other(s) (please specify) . . . . ☐ ____________

____

A combination of the above . . . . ☐

A modification of the above ____________
(please specify) . . . . ☐

____

Other comments ____

____

____

____

b) How do you rate the text(s) and/or lab manual(s) you are using for your limited success students?

very suitable . . . . ☐
suitable . . . . ☐
somewhat suitable . . . . ☐
unsuitable . . . . ☐

Comments ____

____

____

____

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23. How much of your science course for limited success students (grouped or ungrouped) is based on the following?

SCALE:

0 none of the course	1 much less than half the course	2 about half the course	3 much more than half the course	4 almost all the course

Job-oriented science	0	1	2	3	4
Reduced content compared to other classes and students.	0	1	2	3	4
Present B.C. Ministry of Education Core Curriculum	0	1	2	3	4
An alternative structured, sequential science program	0	1	2	3	4
Content determined by teacher through students' interests.	0	1	2	3	4
Content chosen by students.	0	1	2	3	4
Less complex activities compared to other classes and students.	0	1	2	3	4

24. How often do you involve your limited success students in the following activities and approaches?

SCALE:

0 Never	1 Once or twice a Term	2 Once or twice a month	3 Once or twice a week	4 Almost every class period

Students doing experiments (teacher arranged)	0	1	2	3	4
Discussion	0	1	2	3	4
Lecture and notes	0	1	2	3	4
Demonstrations	0	1	2	3	4
Students doing experiments (discovery method)	0	1	2	3	4
Programmed learning	0	1	2	3	4
Project work	0	1	2	3	4
Work sheets	0	1	2	3	4
Field trips	0	1	2	3	4
Individualized or small group learning	0	1	2	3	4
Testing	0	1	2	3	4
Oral presentations	0	1	2	3	4
Review to reinforce skills and concepts	0	1	2	3	4
Use of audio-visual aids (eg. films, overheads, slides)	0	1	2	3	4

25. a) Have you developed a special science program for your limited success students?

Yes ☐ No ☐ (if No please proceed to question 27)

b) (Multiple Response Item)

Since you have developed a special science program for your limited success students (in a grouped or ungrouped situation), in what way is this program evaluated?

Evaluated by student achievement based on standardized tests . . . . ☐

Evaluated by student achievement based on teacher designed tests . . . . ☐

Evaluated through student attitude and interest . . . . ☐

Evaluated through formal science department discussions . . . . ☐

Not formally evaluated . . . . ☐

Other (please specify) ______________________________

____

26. a) Who evaluates the progress of your limited success students?

Evaluation solely by teacher . . . . ☐

Evaluation mainly by teacher, partially by student . . ☐

Evaluation equally by teacher and student . . . . . . ☐

Evaluation mainly by student, partially by teacher . . ☐

Evaluation solely by student . . . . ☐

Other (please specify) . . . . ☐

____

b) Approximately what percentage do each of the following contribute to the evaluation of your limited success science students?

	0	up to 20%	up to 40%	up to 60%	up to 80%	up to 100%
Student lab write-ups						
Projects						
Oral talks						
Tests						
Attitude						
Attendance						
Other (please specify)						

c) (Multiple Response Item)

How is the progress of your limited success students reported?

- formal letter grades (A, B, C, D, E) . . . ☐
- satisfactory/unsatisfactory . . . . ☐
- Pass/fail/incomplete . . . . ☐
- Anecdotal . . . . ☐
- Other (please specify) . . . . ☐

____

Comments related to this portion of the questionnaire: _________

____

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THANK YOU VERY MUCH FOR YOUR TIME AND COOPERATION

Please return this questionnaire in the self-addressed, pre-stamped envelope provided. The return of this questionnaire is requested by May 24, 1978.

For further information or inquiries please contact:

Mr. P.S. Healy (phone 228-4969)

or

Dr. R.W. Carlisle (phone 228-5056)

c/o Faculty of Education
Science Education Department
University of British Columbia
2075 Wesbrook Place
Vancouver, B.C. V6T 1W5

If you wish to receive a copy of the final report resulting from this survey please contact the people above or write your name and address in the space provided below.

____

____

APPENDIX B

Sampling Information

Description of Sampling Frame Used for Mr. Peter Healy

Phase I: Determining the eligible science teachers and assigning them to one of the categories of science teachers.

1. Categories:
   1) Grade 8 Science teacher
   2) Grade 9 Science teacher
   3) Grade 10 Science teacher

2. The September 30, 1977 Form J teacher information file, sorted by school code, was used to ensure a geographic representation in the final sample. All teacher records were examined to determine which secondary grade/subjects were taught by each teacher.

3. Teachers who had listed their teaching position (item 33) as:

   - Other School Instructional Staff (code 6)
   - Principal of More than One School (code 7)
   - District-wide Supervisor (code 8)
   - Other District-wide Instructional staff (code 9)

   were rejected from further consideration.

4. Remaining teachers were examined to determine the number of times they qualified as a teacher of one of the 3 categories. (A teacher may teach several classes of secondary science programs and may therefore qualify for several categories.)
   Secondary level grades and subjects were picked from items 46-59.

   Example:

   A teacher who has filled in items 46-59 with

   1 class Science 8
   2 classes Science 9
   1 class Science 10

   qualifies 4 times (for the 4 science classes).

5. Teachers are systematically assigned to one of the categories in which they have qualified.

   Example: In the above case the teacher qualified four times. He therefore has a 1/4th chance of being assigned to each of these categories. Teachers who qualify four times are systematically assigned as follows: the first teacher is assigned to the first category where he qualifies, the second to the second, ...the fourth teacher to the fourth, the fifth teacher to the first category, etc.

In the above example the teacher has the following probabilities of assignment:

1/4 to Grade 8
2/4 to Grade 9
1/4 to Grade 10

6. Following the above procedure, teachers are assigned to one and only one category.
(Note: if the teacher teaches none of the Secondary Level Science courses and grade combinations, he is rejected from consideration.)

The attached table shows the number of teachers assigned to each of these categories according to the Geographic Zone in which they teach and for the Province as a whole.

Phase II: Selecting the actual sample of teachers in each of the categories.

1. Because of the numbers of teachers assigned to each category, the following procedure was adopted in order to select an appropriate sample size:

- The list of teachers was sorted into the appropriate categories and listed by zone (region) within category.
- Picking a number at random between 1 and 3, this teacher was chosen from the first zone in each category.
- Every 3rd teacher thereafter in each category was picked to arrive at a 33% sample, proportion to zones.

Codes Used in Items 46-59

50300	Agriculture		All codes used for Junior Level categories.
14214	General Science		
12700	Human Life Sciences (Health)		
50900	Biology	only these codes used for Senior Level categories	
81500	Chemistry		
83000	Physics		
81800	Earth Sciences/Geology		

Reasons for Excluding Teaching Position Codes 6-9

Special teachers such as music, library are code 6 and are generally not teaching any Science.

Codes 7-9 are teachers with more than one school and therefor cannot properly answer the facility questions on the questionnaires.

GROUP	NAME	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	PROV.
1	K.	0	0	0	0	0	0	0
2	GRADE 1	0	0	0	0	0	0	0
3	GRADE 2	0	0	0	0	0	0	0
4	GRADE 3	0	0	0	0	0	0	0
5	GRADE 4	0	0	0	0	0	0	0
6	GRADE 5	0	0	0	0	0	0	0
7	GRADE 6	0	0	0	0	0	0	0
8	GRADE 7	0	0	0	0	0	0	0
9	G 8 SC.	79	133	47	87	27	66	439
10	G 9 SC.	68	142	50	81	37	47	425
11	G10 SC	53	153	58	92	32	56	444
12	G11 BIO	0	0	0	0	0	0	0
13	G11 CHEM	0	0	0	0	0	0	0
14	G11 PHY	0	0	0	0	0	0	0
15	G11 E.SC.	0	0	0	0	0	0	0
16	G12 BIO	0	0	0	0	0	0	0
17	G12 CHEM	0	0	0	0	0	0	0
18	G12 PHY	0	0	0	0	0	0	0
19	G12 GEOL	0	0	0	0	0	0	0
20	TOTAL	200	428	155	260	96	169	1308

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